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HYDRAULIC WALL-DAM

TECHNICAL FIELD OF THE INVENTION

This invention relates to the field of the design and construction of water retaining walls and dams of all heights.

BACKGROUND OF THE INVENTION

The presently existing dams comprise water-retaining dykes that are constructed in two main families: - concrete structures most often in the shape of an arc, simple or multiple vaults with or without reinforcements. In all these cases, the forces are offset and concentrated in a considerable way onto vault supports, often natural rock or reinforcements.

- weight dams by dykes comprising different layers of landfills for holding water by the own weight of the fills and water tightness by the quality and constitution of these fills. From the fact of the admissible slopes, the quantities of fill to use are considerable.

In all cases, these dams are perfectly watertight.

SUMMARY OF THE INVENTION

This invention consists of building weight-type dams in light concrete and modular structures, water-permeable in such a way as to mobilise the weight of the water to contribute to the resistance of the dam. This permeability must be controlled with a controlled permanent flow in terms of flow and velocity, by the play of hydraulic pressures. Regardless of the water height, by mobilising the own weight of the water and with modular systems, the structures can be lightened considerably and the construction of the works is considerably simplified.

The invention will become more fully apparent from the following detailed description thereof taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic vertical cross-sectional view of a hydraulic Dam according to the invention.

Figure 2 is a schematic fragmentary horizontal cross-sectional view of the Dam represented on figure 1.

Figure 3 is a fragmentary perspective view of the Dam.

Figure 4 is a fragmentary perspective view of a prefabricated module for the shafts used in the Dam represented on figures 1 to 3.

Figure 5 is a horizontal cross-sectional view of a 15m water retaining height dam.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

This invention concerns the construction of a wall-dyke dam: according to figure 1 (which represents a cross-section of a part of the dyke structure), behind a concrete veil screen (1) hollow shafts are positioned (2) filled with water and of variable and decreasing level, in a regular and identical way downstream.

These shafts comprise concrete structures (3) in tubular shape and different sections, which can be prefabricated.

These successive shafts of decreasing height behind the screen serve as counter-weights, with the own weight of the water, for the stability of the whole on the base (13). This is anchored in the ground by anchors (A) adapted to the terrain, and which can be, for example, piles for fitted out terrains.

The forces are transmitted from adjacent frameworks from cells to cells, and the whole is linked together by reinforcements in the concrete blocks (BA). (FIGURE 2) The whole thus constitutes a homogenous water dyke with a lightened and standardised structure. From this, it contains large volumes of mobilised water and a weight mass ensuring the stability of the retaining of the height of water.

The hydraulic pressure forces are limited on each wall to the pressure linked with only the difference of the height of water in the two adjacent water columns, and are thus considerably reduced.

The structure of the shafts operates like short brackets with high inertias, and the forces are reduced to vertical and horizontal forces resumed from one adjacent to the other by the structure and weight of the water.

The forces are distributed between all the cells, and the greatest safety of the whole is guaranteed, including the seismic dimension.

The forces are distributed in a linear way along the structure, and can be resumed regardless of the nature of the land.

According to the constraints proper to each site, a dam could also be partially built with permeable block piles according to this device, and traditional water

tight parts or mobile parts for water regulation.

The water is distributed in the shafts from openings (4). The shaft volumes are calculated to ensure the energy dissipation from the water flow from one shaft to another. This dissipation is necessary to allow the regularity of flow from one column to another.

The speed of flow from shaft Cl to shaft C2, is directly linked to the water pressure difference of Cl to C2. This difference is directly linked with the water height difference (h) between these two shafts. The speed is thus perfectly controlled in proximity, from shaft to shaft. All the shafts are linked with each other by openings by height classes, and the water level is thus the same for the whole dam from the fact of the principle of communicating vessels.

The high level of the water in the shafts is guaranteed by a secondary flow of overflow at the top part through breaches (6). This outflow is made permanent by the very low decrease of (4) of water flow. Thus the inflow of the upstream shaft is always higher than the inflow in the downstream shaft. The excess provides the function of an overflow and guarantees the permanent filling of the shaft.

From the principle of communicating vessels, when the dam level is going to go down, the high shafts will no longer be supplied, but the downstream ones will always remain in function according to the real level of the dam. The water level and hydrostatic balance between the shafts is thus independent from the dam water level variation.

Maintenance is reduced to the water circulation not being obstructed. There is no machinery and no moving parts. Only natural flow in a precise configuration, regardless of the water retaining high levels, whether this is in high or low water level periods.

The description is illustrated by the following figures: Figure 1 represents a cross section of the example of a retainer with octagon shaped shafts.

Figure 2 represents a bird's eye view of this section, where the water levels from N1 to N6 are decreasing, of a same height h, spread across two rows RI and R2. The number of rows ensuring control over the water levels could be very variable according to the configuration of sites and the water pressure forces proper to each case.

Figure 3 illustrates a disposition where decrease h is done over a row RI, row R2 having only hydraulic communication with row RI. This illustrates the fact that the water levels are the same between row RI and the communicating

rows R2, but it is the decrease of row RI that gives the shape of the dam.

Figure 4 represents an example of a prefabricated module for the shafts. The water tightness is ensured by a seal (8) covered with a clay substance, for it does not degrade.

Figure 5 shows an example of a 15 m water retaining height dam.

Projected industrial application

The essential of the dam structure comprises water-filled shafts.

The manufacture of components of these shafts, from the fact of their shape, is simple and economical, and can call upon industrial prefabrication. This considerably simplifies construction and reduces the time for building dams regardless of their size.

The principle of weight stability is similar to that of earth weight dams, but with a considerably lightened structure, since it is made up mainly of water, which goes itself into holes for this purpose.

The quantity of materials for building is no more than 5% of the volumes in a weight dam.

This innovation of a water weight dam based on successive water reservoirs between which the water circulates, responds to a problem that has been badly dealt with until now. That problem is one of the free movement of aquatic life of any kind. This is presently a major problem for the conservation and development of wildlife.

This solution, which is simple to service and economical, is perfectly suited to developing countries. Moreover, it considerably limits technical risks, including earthquakes.

Durable development aspect and ecology

The resources of hydroelectric energy without CO^2 production remain considerable and especially in low falls. But, the use of this energy remains low, despite needs, on account of the negative ecological aspect linked with obstructing the movement of fish by traditional dams and the ensuing decline of stocks over decades. This invention is designed to eliminate these problems to allow the deployment of new equipment in the framework of durable energy.

The simple and modular maintenance-free construction is a part of the present economic objectives and structure durability.